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(54) Abstract Title  
Method of treating fabric

(57) A method of treating fabric comprises wetting the fabric and drying the wet fabric in a domestic tumble dryer in the presence of a composition comprising a polymerisable monomer which forms a cross-linked polymer network on the fabric during drying.

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**METHOD OF TREATING FABRIC**Technical Field

- 5 This invention relates to a method of treating a fabric, in particular a method of treating a fabric during drying. The invention also relates to a fabric care composition and to the use of the composition in the treatment of fabric.

10 Background and Prior Art

- The creasing of fabrics is an almost inevitable consequence of cleaning fabrics, such as in a domestic laundering process. Fabrics also become creased in wear. Creasing can be a particular problem for fabrics which contain cellulosic fibres such as cotton because the creasing is often difficult to remove. Generally, the creases which are developed in a fabric during laundering are removed by ironing. However, because ironing is seen as a time consuming chore, there is an increasing trend for fabrics to be designed such that the need for ironing is reduced or eliminated altogether and/or the effort required for ironing is lower.
- 25 Methods of drying wet fabric can cause the fabric to become creased. For example, when fabrics (such as cotton fabrics) are dried in a conventional, domestic tumble dryer, the resulting dry fabric is generally creased to some extent.
- 30 Compositions for reducing the wrinkling of fabric are described in WO 96/15309 and WO 96/15310. The compositions

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contain a silicone and a film-forming polymer and it appears that it is the lubricating effect of the silicone which is responsible for their anti-wrinkle properties. This conclusion is supported by the fact that a wide variety of polymers is mentioned as being suitable for use in the compositions.

Industrial treatments of fabrics, using pre-formed polymers, to reduce their tendency to crease are known. JP-A-04-50234 describes a textile treatment in which the crease resistance of a plain weave cotton fabric is increased by applying a so-called "shape memory resin" to the fabric. However, this document teaches that the resin is applied to the fabric at a relatively high amount of 10% by weight on weight of fabric and it is not clear how this level of resin affects other properties of the fabric.

A relationship between polymer elastic properties and the ability to impart improved wrinkle recovery to cotton fabric is described by Rawls et al in *Journal of Applied Polymer Science*, vol. 15, pages 341-349 (1971). A variety of different pre-formed polymeric elastomers was applied to fabric and, particularly in the few cases where thermoplastic elastomers were used, the polymers were applied to the fabric at the relatively high levels of 4% and above.

The treatment of fabrics with cross-linking agents in order to impart antiwrinkle properties is known. Compounds such as formaldehyde-based polymers, DMDHEU (dimethylol dihydroxy ethylene urea) and BTCA (butyl-1,2,3,4-tetracarboxylic acid)

may be used as the cross-linking agent. However, these treatments have the disadvantage of reducing the tensile strength of the fabrics.

- 5 The grafting of polymers of hydrophilic monomers onto cellulose is described in EP-A-0811718. The treatment of woven or knitted cellulosic fabrics occurs at a high temperature of 80°C to 200°C in this industrial process.
- 10 US 5204175 describes the production of a water absorptive fabric by heating fabric impregnated with a polymerisable monomer and a cross-linking agent in the presence of a water soluble resin.
- 15 Industrial treatments of fabric to impart permanent creases or to improve wet crease recovery are disclosed in US 3434161 and US 3505002, US 3434161 involves the polymerisation of vinyl groups, previously bound to the cellulose of the fabric, using high energy ionising
- 20 radiation. US 505002 describes the formation of polymers on textiles by reacting a nitrogenous product with formaldehyde.

- Graft polymerisation of acrylamide onto cotton in industrial
- 25 textile treatments is described in Ghosh et al, Journal of Applied Polymer Science, Vol. 58, 1727-1734 (1995) and Hebeish et al, American Dyestuff Reporter, September 1983, 48-64.

Grafting of acrylic acid onto cotton fabric is disclosed in Hebeish et al, Journal of Applied Polymer Science, Vol. 60, 2165-2176 (1996).

- 5 Bhat et al, Textile Res. J, 69 (1) 38-42 (1999) relates to plasma grafted cotton and polyester fabrics.

The production of crease-resistant cottons by polymerising N-methylol acrylamide onto fabric is disclosed in Moncrieff,  
10 The Textile Manufacturer, June, 1967, 233-235.

Warburton, Textile Research Journal, January, 1970, 68-74 describes creaseproofing cotton by *in situ* polymerisation of N-methylol acrylamide, acrylamide and tetrakis  
15 (hydroxymethyl) phosphonium chloride.

All of the fabric treatments mentioned above are applied to the fabric on an industrial scale, before the fabric has been made up into a finished article (such as a garment).  
20 The treatments are generally carried out in ovens at a high temperature.

The present invention aims to provide an alternative method for reducing the creasing of fabrics which can be applied  
25 domestically (ie, in a domestic environment rather than industrially). In particular, the present invention aims to reduce the creasing of fabrics which occurs during drying of the wet fabric in domestic tumble dryers.

30 Definition of the Invention

Accordingly, the present invention provides a method of treating a fabric which comprises wetting the fabric and drying the wet fabric in a tumble dryer in the presence of a composition comprising a polymerisable monomer which forms a cross-linked polymer on the fabric during drying.

Also provided by the invention is a fabric care composition comprising a textile compatible carrier and a polymerisable monomer which is capable of forming a cross-linked polymer on a fabric during drying of the fabric.

The invention further provides the use of the composition of the invention in the treatment of a fabric as part of a laundering process.

15

#### Detailed Description of the Invention

The present invention involves the formation of a cross-linked polymer on the fabric during drying of the fabric. It will be appreciated that the term "formation of a cross-linked polymer on the fabric" encompasses the formation of a network on and/or in the fibres of the fabric including physical and/or chemical attachment (eg, by grafting onto the polymer).

25

The method of the invention involves wetting the fabric. The term "wetting", as used herein, means increasing the level of water of part or all of the fabric above the normal level of water which is present in the fabric at the ambient temperature, pressure and humidity. Therefore, when wet, all or part of the fabric (preferably all of the fabric)

30

will be saturated with water. The fabric can be wet as a result of a prior treatment, such as, for example, washing and rinsing in a laundering process. Alternatively, the fabric may be wet for other reasons. For example, the  
5 composition which comprises the polymerisable monomer may be (and preferably is) aqueous and the wetting of the fabric may therefore be caused solely or partly by application of the composition to the fabric, eg, by soaking the fabric in the composition or spraying the composition onto the fabric.

10

The composition which is used in the method of the invention comprises a polymerisable monomer. Any monomer which is capable of polymerising on wet fabric during drying of the  
15 fabric can, in principle, be used. The monomer may be polymerisable by free radical, anionic or cationic mechanisms or by a combination of one or more of these mechanisms. The monomer preferably has a molecular weight of 500 daltons or less, more preferably 200 daltons or less.  
20 Advantageously, the monomer is water soluble in order that it can be readily taken up onto wet fabric and/or incorporated into an aqueous composition for application to the fabric.

25 The monomer preferably comprises one or more carbon-carbon double bonds, more preferably one carbon-carbon double bond, through which the polymerisation of the monomer can take place. Suitable groups which provide a polymerisable carbon-carbon double bond include acrylate esters,  
30 acrylamides, acrylic acids or their salts, methacrylate esters, methacrylamides, methacrylic acids or their salts,

vinyl esters, vinyl ethers, sulphonated styrenes and salts thereof and vinyl pyrrolidones. The esters may contain functional groups in the alcohol residue, such as hydroxyl or amino. The monomer may contain functional or non-  
5 functional groups other than those which provide the carbon-carbon double bond(s).

Desirably, the monomer is non-toxic. Preferred monomers include those containing an acrylic acid group, a  
10 methacrylic acid group (or a salt of an acrylic or methacrylic acid group such as a sodium salt), an acrylate ester or methacrylate ester group or an acrylamide or methacrylamide group. Acrylate and methacrylate esters include esters of C<sub>1</sub> to C<sub>6</sub> straight chain or branched,  
15 aliphatic or alicyclic alcohols, preferably di- or polyhydroxylated alcohols (which are more water soluble than the unhydroxylated alcohols).

The invention results in the formation of a cross-linked  
20 polymer network on the fabric. The cross-linking of the polymer may be an inherent consequence of the polymerisation of the monomer; for example, the monomer may contain two or more polymerisable groups. Alternatively, a cross-linking agent may be included in the composition in order to form  
25 the cross-linked polymer. For example, when the monomer contains one polymerisable group and, when polymerised by itself, would not form a cross-linked polymer, a cross-linking agent containing two or more of the same or different polymerisable groups may be included in the  
30 composition to ensure that a cross-linked polymer is formed on the fabric. Therefore, preferred cross-linking agents



include those comprising two or more carbon-carbon double bonds. The carbon-carbon double bonds are preferably provided by the same groups as in the polymerisable monomer. The cross-linking agent, when present in the composition for  
5 use in the method of the invention, is preferably used in an amount of from 0.1 to 15% by weight, preferably 0.5 to 10% by weight, based on the weight of the polymerisable monomer.

10 The composition for use in the method of the invention may contain other components besides the polymerisable monomer and the optional cross-linking agent. For example, the composition may comprise one or more additional  
polymerisable monomers or cross-linking agents, one or more  
15 vehicles or carriers for the composition, an initiator system for the polymerisation reaction and, optionally, stabilisers. Furthermore, when the composition for use in the method of the invention is a fabric care composition of the invention, it may contain further components, as  
20 described hereinbelow.

Vehicles or carriers for the composition include water. Therefore, the composition is preferably aqueous, more preferably an aqueous solution, suspension or dispersion.  
25 The composition preferably contains more than 50% by weight of water.

Initiator systems may be included in the compositions for use in the method of the invention. Initiator systems may  
30 not be required if the monomer polymerises in air and/or light at the temperature at which the fabric is dried.

However, the use of initiator systems is required or is desirable when polymerisation of the monomer does not occur or occurs in an unpredictable manner during drying of the fabric under normal conditions (eg, in the presence of air and light at a temperature of 30°C to 80°C). The initiator system may cause the polymerisation to occur by free radical, anionic or cationic routes. Suitable radical, anionic and cationic initiators are well-known to those skilled in the art. A particularly preferred initiator system for use with monomers containing acrylate, methacrylate, acrylic acid (or salts thereof), methacrylic acid (or salts thereof), acrylamide or methacrylamide groups comprises hydrogen peroxide and ascorbic acid. When hydrogen peroxide and ascorbic acid are used as the initiator, they are preferably used in an amount of up to 10% (more preferably 0.1 to 5%) by weight based on total weight of polymerisable monomer.

The composition is applied to the fabric in an amount such that creasing of the fabric is reduced (relative to fabric not treated with the composition) by the formation of the cross-linked polymer on the fabric. Preferably, the composition is applied to the fabric in an amount such that the amount of polymerisable monomer is from 0.1 to 10% by weight on weight of fabric (owf), more preferably 0.1 to 5% owf. The amount of the cross-linked polymer formed on the fabric is preferably from 0.1 to 10% by weight on weight of fabric (owf), more preferably from 0.1 to 6% owf.

The method of the invention is preferably carried out as part of a laundering process. Laundering processes include

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large scale and small scale (eg, domestic) laundering of fabric. The method of the invention can be part of a conventional laundering process. Thus, the composition which is used in the method of the invention may be a fabric  
5 care composition of the invention, as described hereinbelow, and may be used at any convenient stage of a laundering process, for example when the fabric is already wet after a washing or rinsing step. The composition may therefore be in the form of a rinse adjunct or a fabric softening and/or  
10 conditioning composition. Alternatively, the method of the invention may be carried out as a separate step either as part of, or independently from, the laundering process. Suitable product forms therefore also include products suitable for use in a method which involves soaking the wet  
15 or dry fabric in a solution of the composition and/or spraying the composition onto wet or dry fabric.

Drying of the fabric is carried out in a tumble dryer. The temperature in the tumble dryer may vary from 40°C to 80°C.  
20 The formation of a cross-linked polymer network on the fabric preferably takes place from 1 to 15 minutes (more preferably 2 to 15 minutes) after the start of the drying process. In the first minute or so of drying wet fabric in a tumble dryer, creases formed in the wet fabric tend to be  
25 dissipated. After 15 minutes of drying in a tumble dryer, creases can become strongly formed in the fabric on account of the low moisture content of the fabric.

The term "tumble dryer", as used herein, covers any device  
30 for drying wet fabric which causes the fabric to move, under the influence of gravity, through air at an elevated

temperature within a container (eg, a drum), preferably by rotation of part of the device (eg, the drum). Preferably, the tumble dryer is adapted for domestic use, rather than industrial or other large scale use.

5

The fabrics which may be treated in the present invention may be synthetic or may comprise cellulosic fibres, preferably from 1% to 100% cellulosic fibres (more preferably 5% to 100% cellulosic fibres, most preferably 40%  
10 to 100%). When the fabric contains less than 100% cellulosic fibres, the balance comprises other fibres or blends of fibres suitable for use in garments such as synthetic fibres, eg polyester, for example. Preferably, the cellulosic fibres are of cotton or regenerated cellulose  
15 such as Viscose (TM), Tencel (TM) or Modal (TM). The fabrics may be in the form of one or more garments.

The composition which may be used in the method of the invention may be a fabric care composition of the invention.

20

The fabric care composition of the invention comprises a textile compatible carrier.

The nature of the textile compatible carrier will be  
25 dictated to a large extent by the stage at which the composition of the invention is used in a laundering process, the compositions being capable of being used, in principle, at any stage of the process. For example, where the compositions are for use as main wash detergent  
30 compositions, the one or more textile compatible carriers comprise a detergent active compound. Where the

compositions are for use in the rinsing step of a laundering process, the one or more textile compatible carriers may comprise a fabric softening and/or conditioning compound.

- 5 The compositions of the invention preferably comprise a perfume, such as of the type which is conventionally used in fabric care compositions. The compositions may be packaged and labelled for use in a domestic laundering process.
- 10 Preferably, the fabric care composition is used to treat the fabric in the rinse cycle of a laundering process. The rinse cycle preferably follows the treatment of the fabric with a detergent composition.

15 Detergent Active Compounds

- If the fabric care composition of the present invention is in the form of a detergent composition, the textile-compatible carrier may be chosen from soap and non-soap
- 20 anionic, cationic, nonionic, amphoteric and zwitterionic detergent active compounds, and mixtures thereof.

- Many suitable detergent active compounds are available and are fully described in the literature, for example, in
- 25 "Surface-Active Agents and Detergents", Volumes I and II, by Schwartz, Perry and Berch.

- The preferred textile-compatible carriers that can be used are soaps and synthetic non-soap anionic and nonionic
- 30 compounds.

- Anionic surfactants are well-known to those skilled in the art. Examples include alkylbenzene sulphonates, particularly linear alkylbenzene sulphonates having an alkyl chain length of C<sub>8</sub>-C<sub>15</sub>; primary and secondary alkylsulphates, particularly C<sub>8</sub>-C<sub>15</sub> primary alkyl sulphates; alkyl ether sulphates; olefin sulphonates; alkyl xylene sulphonates; dialkyl sulphosuccinates; and fatty acid ester sulphonates. Sodium salts are generally preferred.
- 10 Nonionic surfactants that may be used include the primary and secondary alcohol ethoxylates, especially the C<sub>8</sub>-C<sub>20</sub> aliphatic alcohols ethoxylated with an average of from 1 to 20 moles of ethylene oxide per mole of alcohol, and more especially the C<sub>10</sub>-C<sub>15</sub> primary and secondary aliphatic
- 15 alcohols ethoxylated with an average of from 1 to 10 moles of ethylene oxide per mole of alcohol. Non-ethoxylated nonionic surfactants include alkylpolyglycosides, glycerol monoethers, and polyhydroxyamides (glucamide).
- 20 Cationic surfactants that may be used include quaternary ammonium salts of the general formula  $R_1R_2R_3R_4N^+ X^-$  wherein the R groups are independently hydrocarbyl chains of C<sub>1</sub>-C<sub>22</sub> length, typically alkyl, hydroxyalkyl or ethoxylated alkyl groups, and X is a solubilising anion (for example,
- 25 compounds in which R<sub>1</sub> is a C<sub>8</sub>-C<sub>22</sub> alkyl group, preferably a C<sub>8</sub>-C<sub>10</sub> or C<sub>12</sub>-C<sub>14</sub> alkyl group, R<sub>2</sub> is a methyl group, and R<sub>3</sub> and R<sub>4</sub>, which may be the same or different, are methyl or hydroxyethyl groups); and cationic esters (for example, choline esters) and pyridinium salts.

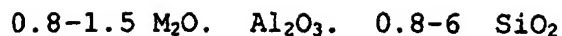
The total quantity of detergent surfactant in the composition is suitably from 0.1 to 60 wt% e.g. 0.5-55 wt%, such as 5-50wt%.

- 5 Preferably, the quantity of anionic surfactant (when present) is in the range of from 1 to 50% by weight of the total composition. More preferably, the quantity of anionic surfactant is in the range of from 3 to 35% by weight, e.g. 5 to 30% by weight.
- 10 Preferably, the quantity of nonionic surfactant when present is in the range of from 2 to 25% by weight, more preferably from 5 to 20% by weight.
- 15 Amphoteric surfactants may also be used, for example amine oxides or betaines.

- The compositions may suitably contain from 10 to 70%, preferably from 15 to 70% by weight, of detergency builder.
- 20 Preferably, the quantity of builder is in the range of from 15 to 50% by weight.

- The detergent composition may contain as builder a crystalline aluminosilicate, preferably an alkali metal
- 25 aluminosilicate, more preferably a sodium aluminosilicate.

- The aluminosilicate may generally be incorporated in amounts of from 10 to 70% by weight (anhydrous basis), preferably from 25 to 50%. Aluminosilicates are materials having the
- 30 general formula:



where M is a monovalent cation, preferably sodium. These materials contain some bound water and are required to have  
5 a calcium ion exchange capacity of at least 50 mg CaO/g. The preferred sodium aluminosilicates contain 1.5-3.5 SiO<sub>2</sub> units in the formula above. They can be prepared readily by reaction between sodium silicate and sodium aluminate, as amply described in the literature.

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#### Fabric Softening and/or Conditioner Compounds

If the composition of the present invention is in the form of a fabric conditioner composition, the textile-compatible  
15 carrier will be a fabric softening and/or conditioning compound (hereinafter referred to as "fabric softening compound"), which may be a cationic or nonionic compound.

The softening and/or conditioning compounds may be water  
20 insoluble quaternary ammonium compounds. The compounds may be present in amounts of up to 8% by weight (based on the total amount of the composition) in which case the compositions are considered dilute, or at levels from 8% to about 50% by weight, in which case the compositions are  
25 considered concentrates.

Compositions suitable for delivery during the rinse cycle may also be delivered to the fabric in the tumble dryer if used in a suitable form. Thus, another product form is a  
30 composition (for example, a paste) suitable for coating onto, and delivery from, a substrate e.g. a flexible sheet



or sponge or a suitable dispenser during a tumble dryer cycle.

- Suitable cationic fabric softening compounds are
- 5 substantially water-insoluble quaternary ammonium materials comprising a single alkyl or alkenyl long chain having an average chain length greater than or equal to C<sub>20</sub> or, more preferably, compounds comprising a polar head group and two alkyl or alkenyl chains having an average chain length
- 10 greater than or equal to C<sub>14</sub>. Preferably the fabric softening compounds have two long chain alkyl or alkenyl chains each having an average chain length greater than or equal to C<sub>16</sub>. Most preferably at least 50% of the long chain alkyl or alkenyl groups have a chain length of C<sub>18</sub> or above.
- 15 It is preferred if the long chain alkyl or alkenyl groups of the fabric softening compound are predominantly linear.

- Quaternary ammonium compounds having two long-chain aliphatic groups, for example, distearyldimethyl ammonium
- 20 chloride and di(hardened tallow alkyl) dimethyl ammonium chloride, are widely used in commercially available rinse conditioner compositions. Other examples of these cationic compounds are to be found in "Surface-Active Agents and Detergents", Volumes I and II, by Schwartz, Perry and Berch.
- 25 Any of the conventional types of such compounds may be used in the compositions of the present invention.

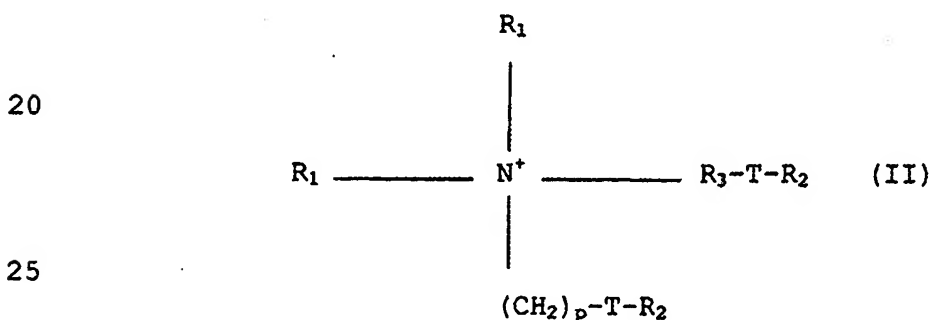
- The fabric softening compounds are preferably compounds that provide excellent softening, and are characterised by a
- 30 chain melting L $\beta$  to L $\alpha$  transition temperature greater than 25°C, preferably greater than 35°C, most preferably greater

than 45°C. This L $\beta$  to L $\alpha$  transition can be measured by DSC as defined in "Handbook of Lipid Bilayers", D Marsh, CRC Press, Boca Raton, Florida, 1990 (pages 137 and 337).

Substantially water-insoluble fabric softening compounds are defined as fabric softening compounds having a solubility of less than  $1 \times 10^{-3}$  wt % in demineralised water at 20°C. Preferably the fabric softening compounds have a solubility of less than  $1 \times 10^{-4}$  wt%, more preferably less than  $1 \times 10^{-8}$  to  $1 \times 10^{-6}$  wt%.

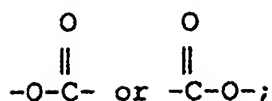
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Especially preferred are cationic fabric softening compounds that are water-insoluble quaternary ammonium materials having two C<sub>12-22</sub> alkyl or alkenyl groups connected to the molecule via at least one ester link, preferably two ester links. An especially preferred ester-linked quaternary ammonium material can be represented by the formula II:



wherein each R<sub>1</sub> group is independently selected from C<sub>1-4</sub> alkyl or hydroxyalkyl groups or C<sub>2-4</sub> alkenyl groups; each R<sub>2</sub> group is independently selected from C<sub>8-28</sub> alkyl or alkenyl groups; and wherein R<sub>3</sub> is a linear or branched alkylene group of 1 to 5 carbon atoms, T is

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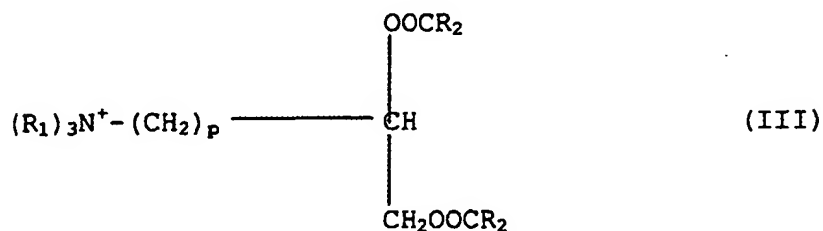
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and  $p$  is 0 or is an integer from 1 to 5.

Di(tallowoxyloxyethyl) dimethyl ammonium chloride and/or its hardened tallow analogue is especially preferred of the compounds of formula (II).

A second preferred type of quaternary ammonium material can be represented by the formula (III):

15



20

wherein  $\text{R}_1$ ,  $p$  and  $\text{R}_2$  are as defined above.

25 It is advantageous if the quaternary ammonium material is biologically biodegradable.

Preferred materials of this class such as 1,2-bis(hardened tallowoyloxy)-3-trimethylammonium propane chloride and their methods of preparation are, for example, described in US 4 137 180 (Lever Brothers Co). Preferably these materials comprise small amounts of the corresponding monoester as described in US 4 137 180, for example, 1-hardened tallowoyloxy-2-hydroxy-3-trimethylammonium propane chloride.

35

Other useful cationic softening agents are alkyl pyridinium salts and substituted imidazoline species. Also useful are primary, secondary and tertiary amines and the condensation products of fatty acids with alkylpolyamines.

5

The compositions may alternatively or additionally contain water-soluble cationic fabric softeners, as described in GB 2 039 556B (Unilever).

- 10 The compositions may comprise a cationic fabric softening compound and an oil, for example as disclosed in EP-A-0829531.

- The compositions may alternatively or additionally contain  
15 nonionic fabric softening agents such as lanolin and derivatives thereof.

Lecithins are also suitable softening compounds.

- 20 Nonionic softeners include L $\beta$  phase forming sugar esters (as described in M Hato et al Langmuir 12, 1659, 1666, (1996)) and related materials such as glycerol monostearate or sorbitan esters. Often these materials are used in conjunction with cationic materials to assist deposition  
25 (see, for example, GB 2 202 244). Silicones are used in a similar way as a co-softener with a cationic softener in rinse treatments (see, for example, GB 1 549 180).

- The compositions may also suitably contain a nonionic  
30 stabilising agent. Suitable nonionic stabilising agents are

linear C<sub>8</sub> to C<sub>22</sub> alcohols alkoxyated with 10 to 20 moles of alkylene oxide, C<sub>10</sub> to C<sub>20</sub> alcohols, or mixtures thereof.

Advantageously the nonionic stabilising agent is a linear C<sub>8</sub> to C<sub>22</sub> alcohol alkoxyated with 10 to 20 moles of alkylene oxide. Preferably, the level of nonionic stabiliser is within the range from 0.1 to 10% by weight, more preferably from 0.5 to 5% by weight, most preferably from 1 to 4% by weight. The mole ratio of the quaternary ammonium compound and/or other cationic softening agent to the nonionic stabilising agent is suitably within the range from 40:1 to about 1:1, preferably within the range from 18:1 to about 3:1.

The composition can also contain fatty acids, for example C<sub>8</sub> to C<sub>24</sub> alkyl or alkenyl monocarboxylic acids or polymers thereof. Preferably saturated fatty acids are used, in particular, hardened tallow C<sub>16</sub> to C<sub>18</sub> fatty acids.

Preferably the fatty acid is non-saponified, more preferably the fatty acid is free, for example oleic acid, lauric acid or tallow fatty acid. The level of fatty acid material is preferably more than 0.1% by weight, more preferably more than 0.2% by weight. Concentrated compositions may comprise from 0.5 to 20% by weight of fatty acid, more preferably 1% to 10% by weight. The weight ratio of quaternary ammonium material or other cationic softening agent to fatty acid material is preferably from 10:1 to 1:10.

The fabric conditioning compositions may include silicones, such as predominately linear polydialkylsiloxanes, e.g. polydimethylsiloxanes or aminosilicones containing amine-

functionalised side chains; soil release polymers such as  
block copolymers of polyethylene oxide and terephthalate;  
amphoteric surfactants; smectite type inorganic clays;  
zwitterionic quaternary ammonium compounds; and nonionic  
5 surfactants.

The fabric conditioning compositions may also include an  
agent which produces a pearlescent appearance, e.g. an  
organic pearlising compound such as ethylene glycol  
10 distearate, or inorganic pearlising pigments such as  
microfine mica or titanium dioxide (TiO<sub>2</sub>) coated mica.

The fabric conditioning compositions may be in the form of  
emulsions or emulsion precursors thereof.

15 Other optional ingredients include emulsifiers, electrolytes  
(for example, sodium chloride or calcium chloride)  
preferably in the range from 0.01 to 5% by weight, pH  
buffering agents, and perfumes (preferably from 0.1 to 5% by  
20 weight).

Further optional ingredients include non-aqueous solvents,  
perfume carriers, fluorescers, colourants, hydrotropes,  
antifoaming agents, antiredeposition agents, enzymes,  
25 optical brightening agents, opacifiers, dye transfer  
inhibitors, anti-shrinking agents, anti-wrinkle agents,  
anti-spotting agents, germicides, fungicides, anti-oxidants,  
UV absorbers (sunscreens), heavy metal sequestrants,  
chlorine scavengers, dye fixatives, anti-corrosion agents,  
30 drape imparting agents, antistatic agents and ironing aids.  
This list is not intended to be exhaustive.

Fabric Treatment Products

The composition of the invention may be in the form of a  
5 liquid, solid (e.g. powder or tablet), a gel or paste,  
spray, stick or a foam or mousse. Examples including a  
soaking product, a rinse treatment (e.g. conditioner or  
finisher) or a mainwash product. The composition may also  
be applied to a substrate e.g. a flexible sheet or used in a  
10 dispenser which can be used in the wash cycle, rinse cycle  
or during the dryer cycle.

The invention will now be described by way of example only  
and with reference to the following non-limiting examples.

15

EXAMPLES

Experimental method:

20 Cotton sheeting was used for all testing and ballast. This  
was pre-washed with Persil Non-Biological (trade mark)  
washing powder (100g Persil per 2.5 kg load) at 40°C cotton  
setting (C) in a Zanussi Jetstream (trade mark) machine.  
Cotton sheet sample size was 30 cm x 20 cm.

25

Solutions were made up by mixing the appropriate amounts of  
acrylamide, methylene bisacrylamide, hydrogen peroxide  
solution, ascorbic acid and demineralised water.

These solutions were then immediately padded onto the dry ("flat") cotton samples using a Mathis Padder (pressure-60, 2.5m/min), giving approximately 100% solution pick up.

- 5 After padding, the samples were immediately tumble dried for 20 minutes at the high temperature cotton setting using a Zanussi TD 525 (trade mark) European-style tumble dryer.

- The samples were then removed and assessed for creasing
- 10 intensity against AATCC Wrinkle Recovery (1-5) standards (1 = highly creased, 5 = very flat and intermediate numbers are between these levels of creasing). Each score is the average of three replicates.



Example	Solution Components (% w/w)					Polym* %	%Xlink* *	AATCC Score
	Am	BAm	HPO	AA	Water			
1	0	0	0	0	100	0	-	2
2	0.4	0.01	0.02	0.00	99.5	0.5	3	2.5
3	85	5	7	75	98.9	1	3	3.4
4	0.9	0.03	0.05	0.01	96.8	3	3	3.1
5	70	0	5	5	94.7	5	3	3.5
6	2.9	0.09	0.16	0.04	92.5	7	3	3.7
7	10	0	4	5	89.3	10	3	4.3
8	4.8	0.15	0.27	0.07	94.7	5	0	2.4
9	50	0	3	5	94.7	5	0.5	2.7
10	6.7	0.21	0.38	0.10	94.7	5	1	3.8
11	90	0	2	5	94.7	5	5	3.3
12	9.7	0.30	0.54	0.15	94.7	5	10	3.8
	00	0	5	0				
	5.0	0	0.27	0.07				
	00	0.02	3	5				
	4.9	5	0.27	0.07				
	75	0.05	3	5				
	4.9	0	0.27	0.07				
	50	0.25	3	5				
	4.7	0	0.27	0.07				
	50	0.50	3	5				
	4.5	0	0.27	0.07				
	00		3	5				

Am=acrylamide

BAm=methylene bisacrylamide

HPO=hydrogen peroxide solution (27.5% active)

AA=ascorbic acid

Water=demineralised water

\*% by weight of polymer on the fabric (owf)

5 \*\*% by weight of cross-linker in the solution based on weight of monomer Am

Thus, in all of Examples 1 to 12, the creasing of the fabric was reduced.

10

#### EXAMPLES 13 TO 20

Example 5 was repeated using a variety of different monomers. Treated fabrics were dried in a Miele Novotronic  
15 T430 (trade mark) tumble dryer. The results are set out in the following table.

Example	Solution Components (% w/w)							%Polym	%Xlink	AATCC
	Monomer	Mon. Wt	Xlinker	Xlink. Wt.	HPO	AA	APS			Score WR 1-5
13	SA	4.85	EGDMA	0.15	0.27	0.075		5	3	2.6
14	SA	4.85	BAm	0.15	0.27	0.075		5	3	2.8
15	SMA	4.85	BAm	0.15	0.27	0.075		5	3	3.7
16	HEA	4.85	BAm	0.15	0.27	0.075		5	3	3.6
17	HEMA	4.85	BAm	0.15	0.27	0.075		5	3	3.7
18	SSASS	4.85	BAm	0.15	0.27	0.075		5	3	2.9
19	DMAEA	4.85	BAm	0.15	0.27	0.075		5	3	3.8
20	DMAEA	4.85	BAm	0.15			0.075	5	3	3.5

SA Sodium acrylate  
 SMA Sodium methacrylate  
 HEA 2-Hydroxy ethyl acrylate  
 HEMA 2-Hydroxy ethyl methacrylate  
 DMAEA N,N-dimethyl amino ethyl  
 acrylate  
 SSASS 4-Styrene sulfonic acid,  
 sodium salt  
 EGDMA Ethylene glycol dimethacrylate  
 APS Ammonium persulfate

EXAMPLES 21 TO 23

5

The following rinse conditioner formulations were prepared.

Example	SMA	BAM	HPO	AA	Comfort* Concentrate	DW
1	4.85	0.15	0.27	0.07 5	1.5	93.155
2	4.85	0.15	0.27	0.07 5	37.0	57.655
3	4.85	0.15	0.27	0.07 5	74.1	20.555

SMA - Sodium Methacrylate

10 BAM - Methylene Bis-Acrylamide

HPO - Hydrogen Peroxide (27.5% Active)

AA - Ascorbic Acid

DW - Deionised Water

\*Supplied by Lever Brothers, UK (Comfort is a trade mark) -

15 a standard rinse conditioner

**CLAIMS**

1. Method of treating a fabric which comprises wetting the fabric and drying the wet fabric in a tumble dryer in the presence of a composition comprising a polymerisable monomer which forms a cross-linked polymer on the fabric during drying.
2. Method as claimed in Claim 1, wherein the polymerisable monomer comprises a carbon-carbon double bond provided by a group selected from acrylate esters, acrylamides, acrylic acids or their salts, methacrylate esters, methacrylamides, methacrylic acids or their salts, vinyl esters, vinyl ethers, sulphonated styrenes and salts thereof and vinyl pyrrolidones.
3. Method as claimed in Claim 1 or Claim 2, wherein the polymerisable monomer comprises an acrylic acid or acrylic salt group, an acrylate ester group or an acrylamide group.
4. Method as claimed in any one of Claims 1 to 3, wherein the polymerisable monomer is water soluble.
5. Method as claimed in any one of Claims 1 to 4, wherein the composition is a mixture of a polymerisable monomer and a cross-linking agent.
6. Method as claimed in any one of Claims 1 to 5, wherein the composition comprises an initiator for the polymerisation reaction of the monomer.

7. Method as claimed in Claim 6, wherein the initiator comprises hydrogen peroxide and ascorbic acid.
8. Method as claimed in any one of Claim 1 to 8, wherein  
5 the drying is carried out at a temperature of from 40°C to 80°C.
9. Method as claimed in any one of Claims 1 to 9, wherein the cross-linked polymer is formed from 1 to 15 minutes  
10 after the start of the drying process.
10. Method as claimed in any one of Claims 1 to 9, wherein the cross-linked polymer which is formed on the fabric is present in an amount of from 0.1 to 10% by weight on weight  
15 of fabric.
11. Method as claimed in any one of Claims 1 to 10, wherein the composition is applied to the fabric by spraying.
- 20 12. Method as claimed in any one of Claims 1 to 11 which is part of a domestic laundering process.
13. Fabric care composition comprising a textile compatible carrier and a polymerisable monomer which is capable of  
25 forming a cross-linked polymer on a fabric during drying of the fabric.
14. Composition as claimed in Claim 13 which further comprises a perfume.

15. Composition as claimed in Claim 13 or Claim 14 which is sprayable.

16. Composition as claimed in any one of Claims 13 to 15  
5 which is a rinse adjunct or a fabric softening composition.

17. Composition as claimed in any one of Claims 13 to 16, wherein the composition or the one or more substances have the features of any one of Claims 2 to 7.

10

18. Use of a composition of any one of Claims 13 to 17 in the treatment of a fabric as part of a laundering process.



INVESTOR IN PEOPLE

Application No: GB 0021481.7  
Claims searched: 1-18

Examiner: Martin Price  
Date of search: 21 November 2000

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.R): C3P - PKP; D1P - PDL

Int CI (Ed.7): D06M 14/04

Other: Online - WPI, EPODOC, PAJ

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2295404 A (ICI) - see eg claims and examples	1 and 13 at least
X	GB 2004899 A (Kanebo) - see eg claims and examples	1 and 13 at least
X	EP 0681053 A1 (Nippon) - see eg claims and examples	1 and 13 at least
X	US 5447537 (Louisiana) - see eg claims and examples	1 and 13 at least
X	US 5266632 (ITF) - see eg claims and examples	1 and 13 at least
X	US 4835020 (Mitsubishi) - see eg claims and examples	1 and 13 at least
X	US 4108748 (USA) - see eg claims and examples	1 and 13 at least
X	WPI Accession number 19990-039549[25] & JP 1314782 (Kagitani) - see abstract	1 and 13 at least

X Document indicating lack of novelty or inventive step  
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